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INFORMATION USE IN DECISIONS TO ADOPT AGRICULTURAL INNOVATIONS: THEORETICAL IMPLICATIONS

By Brigitte Duces, College of Library and Information
Services, University of Maryland, College Park, MD
and John M. Strawhorn, Private Consultant,
Silver Spring, MD

Introduction

This study deals with the role of information in the adoption of agricultural innovations. The final objective is two-fold: to increase our knowledge and understanding of the relationship between information use and adoption of innovations and, to provide a basis for improved design and evaluation of agricultural information services. The study uses the field case study technique to collect the necessary data and builds upon existing literature on the diffusion of innovations and decisionmaking. Adoption of an innovation is viewed here from the standpoint of an individual decisionmaker adopting a single innovation in some area relevant to the mission and programs of the U.S. Department of Agriculture (USDA).

Background

Extensive work and literature exist on the diffusion of innovations, especially in agriculture. The discussion generally centers on the variables that influence an innovation's degree and rate of adoption. Relative advantage, triability, complexity, compatibility, and observability are the main characteristics of the innovation that affect its diffusion. Relationships among these different variables, however, have been difficult to determine and to study.

Stages have been developed of the decisionmaking process that could be applied to the process of adopting an innovation. They are descriptive distinctions in a temporal sequence of the various stages through which a decisionmaker supposedly passes while making a decision. Although these stages are derived from observation, they are highly schematized and their application to actual decisionmaking behavior is problematic.

A classification of decision rules has been developed with a corresponding link to information processing. It has been demonstrated that the presentation of information influences the decision rule to be used. Experiments have also demonstrated that the presentation of information (a decision frame) influences decision outcome.

The present study links some of the concepts developed by students of decisionmaking with those established by innovation

diffusion research. Special emphasis has been placed on the role of information in the decisionmaking process as it relates to the adoption of an innovation.

Development of A Descriptive Model

At the heart of the investigation described here is a descriptive framework, or model. This model was developed to provide an organizing structure for the observations and insights gained during the course of the study. It has undergone considerable evolutionary change and refinement; its most current version is shown in Figure 1. The model's message is simple: the process

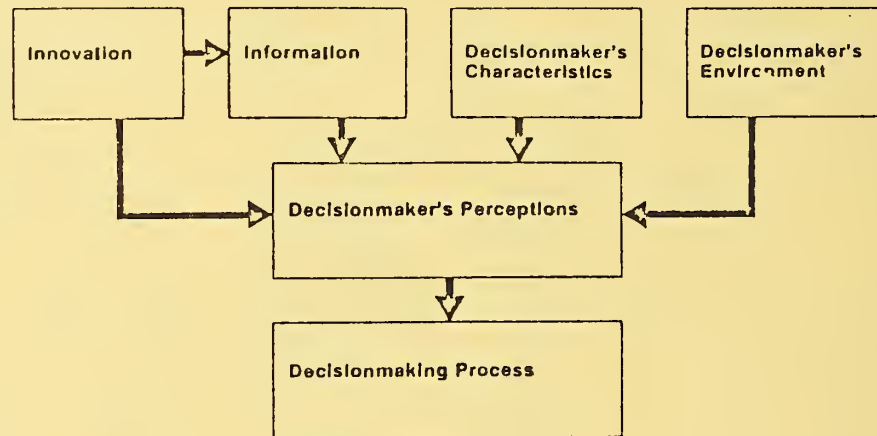


Figure 1. Model of the Role of Information in Decisions to Adopt Innovations

whereby the decisionmaker elects to adopt or reject an innovation is influenced by the innovation (both in its own right and as reflected in information available to the decisionmaker), the decisionmaker's characteristics, and the environment in which the decisionmaker operates; however, this influence is effected through the medium of the decisionmaker's perceptual apparatus. Crucial to the decisionmaker's perceptions are relationships among the various sources of influence—for example, the extent to which the innovation's implied values are consonant with those of the decisionmaker and his environment.

Methodology

Decisions to adopt innovations, and the circumstances that surround those decisions, are extremely complex—that is, many factors impinge, often interactively, on the decisionmaking process. Therefore, a quantitatively based, survey-type investigative technique seemed too narrow and restrictive for this type of study. Instead, an anthropological technique—the field case study—was chosen. In the work described here, a case study consists of the investigation of a specific innovation in a particular locale. A field investigator (occasionally a team of investigators) travels to the locale in which the innovation's

diffusion is being studied, after first collecting substantial background information. The investigator talks to a number of persons (USDA personnel, farmers, consumers, merchants, etc.) in order to reconstruct the course that the innovation has followed. In doing so, the investigator visits the homes or farms of persons known to have considered the innovation; thus, the decisionmaker's behavior and surroundings can be observed directly.

The reconstruction that the investigators establish through their conversations with these informants cover about 30 separate variables, in addition to a detailed profile of each "unit" of communication that seems to have played a role in the decisionmaker's behavior. The information gathered through the case study is then entered into a computerized data base and documented in a hardcopy report.

Typology of Decisions

After the first 12 case studies were completed (the total series will include 36), they were analyzed for patterns or types of decisions, and to refine and simplify the model. It was at this time that the decisionmaker's perceptions and the question of the relationship between the decisionmaker and the innovation's characteristics emerged as being of particular importance. The first factor that was helpful in grouping the case studies into logical clusters was a distinction between "private" and "professional" innovations. Once this distinction was made factors seemed to cluster the cases into meaningful groups: the consonance of the innovation with the decisionmaker's value system, the innovation's continuity with the decisionmaker's previous practices, and the extent to which the innovation could be tried out on a limited scale--that is, to reduce risk, facilitate learning, etc. (Triability did not seem to be important in private decisions.)

Review of this typology enabled the investigators to simplify the mode and reduce the number of variables, and to organize the

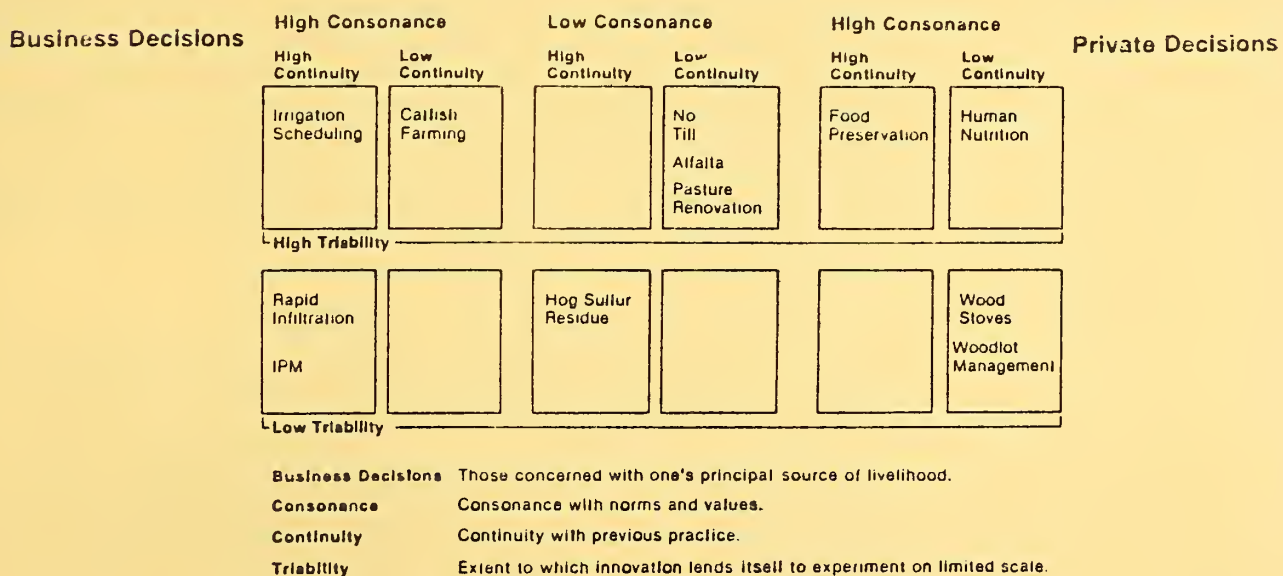


Figure 2. Typology of Decisions

decisionmaker's perceptions into three categories: motivators (the reasons for which a decisionmaker would adopt an innovation), inhibitors (obstacles to adoption), and facilitators (factors which, if present in proper degree, may ease the decision to adopt). This typology emerged from variables surrounding the latter category (facilitators)--consonance with values, continuity with past practices, and triability/visibility.

Further review of the role of these factors led to consideration of a more general underlying factor: the "psychic distance" or "perceived degree of change" required by the innovation. This factor subsumes both consonance with values and continuity with previous practices. The general idea is that any innovation requires the decisionmaker to depart from what he is used to: the greater the "distance" the individual thinks the innovation requires him to travel, the more difficult it will be to adopt that innovation. Triability--the trial adoption of the innovation on a limited scale under reduced conditions of risk--will be used to reduce the degree of change required by the innovation.

From this two-variable relationship, a number of hypotheses have been derived concerning the nature of the relationship and the role of information in decisions to adopt innovations. These hypotheses concern the "difficulty" (i.e., the extent to which an innovation is likely to be resisted) of an innovation, the effect of varying degrees of communication within the community, the importance of congruent messages, the need for credibility and trust of the information sources that promote the innovation, the requirement for personal interaction in obtaining information, the importance of the decisionmaker's perception of the adequacy of information, and the differences between private and business decisions.

Implications

This work, and other investigations along similar lines, can provide a much clearer notion of whether and why information programs are effective in promoting the diffusion of innovations. Of particular value is the highlighting of the role of information in the decisionmaking process, and the consideration of many specific aspects of that information. Further development of the work described in this paper might include a field experiment to test observations and inferences concerning the differential effects of variations in the delivery of information on decisionmakers' behavior.

In addition to enriching our understanding of human behavior, this work could have substantial practical applications; for example, it could make possible a more "engineered" approach to the design and operation of information programs than is conventionally practiced. Specifically, the USDA plans, as an outgrowth of the work described here, to develop a computerized information system that would support such an approach to program design. That application and those plans are described in the article that follows.



INFORMATION USE IN DECISIONS TO ADOPT AGRICULTURAL INNOVATIONS: PRACTICAL APPLICATIONS

By **Gerald Sophar**, National Agricultural Library, U.S.
Department of Agriculture, Beltsville, MD 20705
and **Peter V. Murphy**, Consumer Dynamics, Inc.
Silver Spring, MD

Introduction

The U.S. Department of Agriculture (USDA) is currently taking stock of over 100 years' experience in providing agricultural information services. This comes at a time when government is exacting new standards of program accountability. What did the information program cost? and what difference did it make to users of information? are questions being raised by Congress, the Office of Management and Budget, and agency heads. This paper describes the practical application of research to increase our knowledge and understanding of the relationship between information use and adoption of innovations, and to provide a base for improved design and evaluation of agricultural information services. The research being carried out by USDA, under contract to Consumer Dynamics, Inc., has a Congressional mandate to improve the effectiveness of information services. Congress observed in its mandate that "agencies have only been partially successful in responding to the needs of all persons affected by their research, and useful information produced through such federally supported research is not being effectively transferred to the people of the United States."

Congress supported its mandate with a direct appropriation to USDA to undertake this effort. USDA interpreted this mandate in a statement that poses the question, "How can we help individuals, communities, and organizations do a better job of problem solving and decisionmaking in those areas for which the USDA has a statutory mission to be helpful?" Its efforts have been devoted to addressing this question.

Background

The investigators believe that insufficient attention has been given to the environmental, cultural, educational, and other factors that make up the personality of the individual decisionmaker and determine the decisionmaker's acceptance or rejection of information. The study approach is in contrast to much of the earlier work in the evaluation of information services that focuses on the information product or system rather than on its influences. The approach of the investigation has been to develop a methodology to capture the few essential market factors that seem to be most important in explaining the success or demise of information services. During the investigation, these factors were examined to see how well they explained the characteristics of information services. The results of the research should enable USDA program managers to focus their resources on information/education programs that have a reasonable chance to succeed. A large portion of the research effort was dedicated to the identification of the most influential market factors. The development of a model that associates information use with decisionmaking started with 72 market factors suspected of influencing information use. Further refinement and development of the model revealed that 29 of the

factors were most influential, a few of the most significant being consonance with values, continuity with past practices, and triability.

Development of Market Research Tool

The development of the market research tool for the evaluation and design of information services was based on the relationships between information use and decisionmaking. The experimental application and refinement of the model was embodied in 36 case studies of information use in decisions to adopt or not adopt agricultural innovations. The subjects of the case studies were agricultural problem areas identified by nine panels of nationally recognized experts in the areas of agricultural production, energy, environment, nutrition, and home economics. These selected subjects reflect innovations of national importance where information and education can presumably affect changes in terms of productivity, environmental benefit, energy, or improved nutrition. The convening of panels of experts helped to focus the experimental application of the model on practical problems being experienced in the United States. The 36 subject areas cover 13 broad areas of agricultural concern, identified in the 1977 farm bill.

With the identification of highranking innovations by the experts, investigators proceeded to identify actual field examples of adoption and diffusion of the innovations in widely dispersed locations. In each case, the area to be covered by the investigation was a county or group of contiguous counties. A series of indepth interviews were conducted with adoptors of the innovation, nonadoptors, influencers or facilitators of the innovation, and providers of information services. In all cases, the interviews were conducted in the local settings, farms, and homes of the interviewees.

The interviews were based on a research instrument that was pretested in two case studies and evaluated by an oversight panel of experts in behavioral science and marketing. A refined instrument provided the scope and limit of inquiry on the factors described above. Although it allowed for informal discourse between the investigator and the interviewee, the instrument provided for identification of all the essential elements for entry to an information base.

The information base provides for a matrixlike accumulation of the data from the interviews. For any one of the 36 case studies, individual elements, such as triability, continuity with past practices, or the role of mass media, can be examined. Further, the generic role of mass media or the influence of triability on decisionmaking, or any of the other 29 influential factors, can be examined across case studies.

This information base is the operational element of market research for USDA. In its computerized form, the information base can be searched for a large number or wide variety of factors. How the information base is used in market research can be illustrated by the following example. A USDA program manager is responsible for an information program to promote the planting

of more drought-resistant crops. The information program will be targeted toward five contiguous counties in Oklahoma. The first step is to perform a segmentation of market factors in the target area that are input into the information base. The computer searches the case studies in the information base, identifies the case study that is most similar in terms of the input market segmentation data, and displays the information programs that prove to be successful in that case. The information programs displayed are appropriate for promoting the planting of drought-resistant crops in the target area because the market factors in the target area that have proven to be the most important in the design of these information programs are most closely approximated in the identified case study.

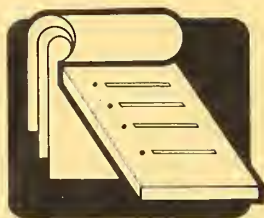
Conclusions

Marketing of information services involves the analysis, planning, implementation, and control of carefully formulated programs designed to bring about voluntary acceptance and use of information by target markets for the purpose of achieving organizational objectives. Within this rather broad definition, USDA's information base for the evaluation and design of information services becomes an essential part of this larger design objective. The instrument that has been designed represents a significant departure from previous approaches to information program design that were oriented to the information product and system as opposed to information/education approaches based on user acceptance. With the information base, USDA is able to design information services that are based on the most relevant experiences within a body of case studies. The process of identifying a case study that is most similar in terms of key market factors is analogous to the process of finding precedences in the legal field to argue case law. The information base helps to identify the characteristics of information based on the selected market factors that are deemed to be the most influential in determining the characteristics of information.

Based on current research, the preliminary conclusion is that the information base is a valuable tool in the evaluation and design of information services. This conclusion is based on the observations of the investigators rather than on the actual observations of USDA personnel in using the information base. The next two steps in the program are, first, to train USDA personnel in market research techniques and use of the information base, and, second, to evaluate the performance of the information base by designing new information services formulated from the information base and then by measuring the effectiveness and impact of the new information services.

Note: The work described in these two articles is supported by the U.S. Department of Agriculture through contract No. USDA 53-3K06-9-76 to Consumer Dynamics, Inc., Rockville, Maryland. The project is under the direction of Gerald Sophar USDA/NAL; the principal investigator is Peter Murphy, Consumer Dynamics; Brigitte Duces and John M. Strawhorn are consultants to the project. These papers were presented at the 44th annual meeting of the American Society for Information Science, October 25-30, 1981, Washington, D.C. and will be published in the Proceedings of the Society.





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Farmer for Louisiana, and Progressive Farmer for Mississippi.

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NEW PUBLICATIONS OF NOTE

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Economic Indicators of the Farm Sector; Income and Balance Sheet Statistics, 1980. (Washington, D.C.) Economic Research Service, U.S. Department of Agriculture (1981). 156 p. (Statistical Bulletin No. 674) Free. Request from Economic Research Service, Publications, Room 0054-S, U.S. Department of Agriculture, Washington, D.C. 20250.

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Farmers, Bureaucrats, and Middlemen. Historical Perspectives on American Agriculture. Trudy Huskamp Peterson, ed. Washington, D.C., Howard University Press, 1981. \$19.95. Order from Howard University Press, 2900 Van Ness Street, N.W., Washington, D.C. 20008. ISBN: 0-88258-083-3.

Food, Agriculture, and Nutrition Inventory (FANI) Prototype Inventory-

1981 Update. (Washington, D.C.) Office of Budget and Program Analysis, U.S. Department of Agriculture (1981). 1024 p. Request from Janes Dumas, USDA, Office of Budget and Program Analysis, Room 150E, Administration Building, Washington, D.C. 20250. Telephone: (202) 382-1274.

The chairman of the Senate Appropriations Committee and its Agricultural Subcommittee in June 1978 asked GAO to work with the Department of Agriculture to develop a prototype inventory of all Federal food, nutrition and agriculture programs. There were 359 programs in the initial inventory covering many aspects of the food, agriculture, and nutrition area with both international and domestic applications. Subsequent updates of the Inventory in May 1980 and 1981 included a 35% expansion of the program in the inventory each year. This catalog contains a reproduction of the computer output from the Food, Agriculture, and Nutrition Inventory (FANI), which is an on-line data base of Federal programs.

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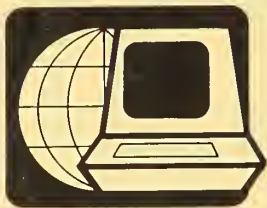


AGRICULTURE DATEBOOK

December 8-11: DOE-ORNL/ASTM Conference: *Energy Conservation in the 80's*. Clearwater, FL. Sponsored by the U.S. Department of Energy, Oak Ridge National Laboratory, American Society for Testing and Materials.

1982

February 2-6: *International Conference on Chemistry and World Food Supplies--The New Frontier (CHEMRAWN II)*. Manila, Philippines. Contact: Joyce Torio, CHEMRAWN II Coordinating Office, International Food Policy Research Institute, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.
(DATEBOOK, Continued on p. 12)



AGRICOLA

Plans are underway to expand the AGRICOLA MARC format to include some added tags for sound recordings, maps and manuscript materials. Revised documentation has been prepared and will be distributed to the AGRICOLA magnetic tape subscribers by mid-October. Additional copies are available from the Information Systems Division, NAL. The expanded format will be implemented with the January, 1982 tape.

NAL also plans to expand the subject category scheme used in AGRICOLA. The new subject categories will first appear on the January, 1982 tape. The new codes are as follows:

E130 Economics of Agricultural Production including:
Agricultural enterprises
Agricultural inputs and outputs
Production policies and programs
Productive capacity of agriculture,
control of production, productive
goals, yields, surplus.

Q006 Food Science and Food
Products--Fish and Aquatic Products

Q106 Food Processing--Fish and
Aquatic Products

Q116 Food Storage--Fish and Aquatic
Products


Q126 Microbiology of Food
Processing--Fish and Aquatic
Products

Q206 Food Contamination and
Toxicology--Fish and Aquatic
Products

Q306 Food Packaging--Fish and Aquatic
Products

Q406 Food Additives--Fish and Aquatic
Products

Q506 Food Composition--Fish and
Aquatic Products.

For further information contact Joseph R. Judy, Chief, Information Systems Division, National Agricultural Library, Beltsville, MD 20705; telephone: (301) 344-3813. 

(DATEBOOK, Continued from p. 11)

February 8-12: *International Society for Human and Animal Mycology*. VIIIth Congress. Palmerston, NZ. Contact: Secretariat, Massey University, University of Extension, P.O. Box 63, Palmerston, New Zealand.

February 16-18: *Ninth Energy Technology Conference & Exposition*. Sheraton Washington Hotel, Washington, D.C. Contact: Martin Heavner, Mgr. Commun. 966 Hungerford Drive #24, Rockville, MD 20850.

March 1-6: *State 4-H and Home Economics Leaders' Workshop*. Chevy Chase, MD. National 4-H Center. Contact: Opal Mann or Eleanor Wilson, SEA/Extension, Room 5407, South Agriculture Building, Washington, D.C. Tel: (202) 447-2908.

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